Considerations in planning vegan diets: Children

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ABSTRACT

This article reviews research on the growth and nutrient intake of vegan children and provides guidelines for counseling parents of vegan children. Although diets of vegan children meet or exceed recommendations for most nutrients, and vegan children have higher intakes of fiber and lower intakes of total fat, saturated fat, and cholesterol than omnivore children, some studies indicate that they may be low in calcium. In addition, bioavailability of zinc and iron from plant foods can be low. Protein needs are slightly higher for vegan children but are easily met with a varied diet that provides adequate energy. Special attention should be given to dietary practices that enhance absorption of zinc and iron from plant foods. Further, good sources of the ϖ-3 fatty acid linolenic acid should be emphasized to enhance synthesis of the long-chain fatty acid docosahexanoic acid. Dietetics professionals who counsel vegan families should help parents identify good sources of vitamin B-12, riboflavin, zinc, calcium and, if sun exposure is not adequate, vitamin D. This should not be problematic, due to the growing number and availability of fortified vegan foods that can help children meet all nutrient needs. Therefore, with appropriate food choices, vegan diets can be adequate for children at all ages. *J Am Diet Assoc. 2001;101:661-669.*

Vegan diets include only plant foods—grains, vegetables, fruits, legumes, nuts, seeds, and vegetable fats. Although the likelihood of nutritional deficiencies increases with more restrictive diets, adequate vegan diets can be planned when parents are committed to appropriate food choices and follow appropriate meal-planning guidelines. According to both The American Dietetic Association (1) and The American Academy of Pediatrics (2), well-planned vegan diets can support normal growth and development in children.

Dietitians who work with parents of vegan children need to be familiar with the nutrition issues specific to vegan diets and must provide adequate and realistic meal-planning guidelines. The purpose of this article is to provide an overview of the literature on vegan diets for children, to identify issues that require particular attention, and to offer recommendations for feeding balanced diets to vegan children.

HEALTH ASPECTS OF VEGETARIAN DIETS

Nutrient intakes of vegan children are generally sufficient and sometimes exceed those of omnivore children. Sanders and Manning (3) found that British vegan school-aged children had higher intakes of fiber and all vitamins and minerals except calcium compared to omnivore children. Similarly, a study of vegan preschoolers in Tennessee (4) also found that average intakes of protein, vitamins, and minerals exceeded recommended levels, with the exception of calcium (5-8).

Older studies conducted with children following more extreme versions of vegan diets should not form the basis for conclusions about adequacy of vegan diets today because most of those studies focused on families on highly restrictive diets not typical of more mainstream vegan families. Also, a much larger variety of nutrient-rich and fortified vegan foods are available today.

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Table 1
Protein recommendations for vegan compared with nonvegan children[a]

Age (yrs)	Weight (kg)	Suggested range for protein (g/kg)	Recommended protein intake (g/day) for vegans	Recommended protein intake (g/day) for nonvegans
1-2 (males and females)	11	1.6-1.7	18-19	13
2-3 (males and females)	13	1.4-1.6	18-21	16
4-6 (males and females)	20	1.3-1.4	26-28	24
7-10 (males and females)	28	1.1-1.2	31-34	28
11-14 (males)	45	1.1-1.2	50-54	45
11-14 (females)	46	1.1-1.2	51-55	46
15-18 (males)	66	1.0-1.1	66-73	59
15-18 (females)	55	0.9-1.0	50-55	44

[a]Protein recommendation for children is based on the Recommended Dietary Allowances for age increased to allow for lower amino acid quality and digestibility.

Vegan diets may reduce risk of some chronic diseases of adulthood that have their origins in childhood. Vegan children have lower intakes of total fat, saturated fat, and cholesterol than omnivore children who typically have intakes of saturated fat and total fat that exceed the levels suggested in the Dietary Guidelines. Vegan children also have higher intakes of fruits and vegetables as evidenced by their higher intakes of vitamin C (3,4). Finally, vegan diets may expose children to a greater variety of whole plant foods, which may help to establish healthful lifelong eating habits.

ENERGY NEEDS AND GROWTH OF VEGAN CHILDREN

Children with adequate energy intakes will typically grow at a predictable rate. Studies of vegan children have indicated that energy intake is close to the recommended level (4) or to intakes of nonvegetarian controls (9).

One study examined 404 children aged 4 months to 10 years who lived in an intentional community in Tennessee (10). The majority of children (73%) were vegan from birth; many (76%) regularly used vitamin and mineral supplements. Means for height for age, weight for age, and weight for height were close to the 50th percentile of the National Center for Health Statistics reference values. Significant differences in height for age Z scores between vegan children and the reference population were only seen for ages 5 years and younger, with these children tending to be slightly shorter than the median of the reference population (–0.24 cm for age less than 1 year, –2.01 cm for age 1 to 2 years, –2.06 cm for age 3 to 4 years). Mean height for age Z scores of vegan children were within the normal range and were not indicative of stunting (11). Although weights for age of the vegan children were slightly below the reference population (–0.09 to –0.37 kg for ages 0 to 8 years), significant differences in weight for age Z scores were only seen at age 9 and 10 years when children were 1.11 kg below the National Center for Health Statistics reference population.

Sanders (12) reported that British vegan children aged 1 to 18 years had heights, weights, and head and chest circumferences that were within the normal range (between the 3rd and 97th percentile) when compared with standards for nonvegetarian British children. Boys tended to be slightly shorter and lighter (below the 50th percentile for nonvegetarian British children) whereas girls tended to be slightly lighter. Growth failure, or failure to thrive, commonly defined as weight for age below the 3rd (or 5th) percentile were not seen in these studies (2).

The limited number of properly designed research studies of growth and the absence of longitudinal studies of vegan children makes it impossible to draw conclusions about growth of vegan children in developed countries. However, a vegan diet based on fruits, vegetables, and cereal gruels may lead to an energy deficit due to low energy density and excessive bulk (13). A diet based on soy products and other legumes, nuts and nut butters, and grains will provide more concentrated sources of energy and can support appropriate growth and development (14).

NUTRIENTS OF SPECIAL INTEREST IN DIETS OF VEGAN CHILDREN

Protein

Dietary protein needs of vegan children are generally met when diets contain adequate energy and a variety of plant foods (2,15). Protein intakes of vegan children have been shown to be similar to those of nonvegetarian children (14) and higher than the standards (4). Amino acid intakes are also higher than the standards (4).

Plant protein sources include soy products such as soy milk, tofu, tempeh, and textured vegetable protein; other legumes; grains; nuts; and seeds. The Recommended Dietary Allowances (RDA) for protein for children is based on an allowance for reference protein that is adjusted as needed for the amino acid composition and digestibility of proteins consumed (5). The adjustment for the amino acid composition of a vegan diet containing a variety of protein sources is typically 20% more protein for children younger than age 2 years or 10% to 15% for children ages 2 to 6 years. Older children have a lower amino acid requirement per unit protein (5) and generally require only a small adjustment of their protein requirements for amino acid composition (16).

When dietary protein comes mainly from plant foods it is about 85% digestible. A reasonable adjustment to the current RDA for protein to account for this lower digestibility would be about 10% to 15% (17). To allow for amino acid composition and digestibility of a vegan diet, it appears that protein needs are increased by 30% to 35% for children younger than age 2 years, 20% to 30% for ages 2 to 6 years, and 15% to 20% for children over age 6 years. Table 1 shows a suggested protein range for vegan children. The range is an additional 2 to 14 g protein daily, which can easily be met in a diet providing adequate energy.

It is generally accepted that combining complementary proteins at each meal is not necessary to ensure adequate

protein intake (1). In children, however, when beans were added to a corn-based diet, the supplementary effect was somewhat less when the beans were added at intervals of more than 6 hours (16), suggesting that there may be some advantage to eating more than 1 protein source at a meal or within a period of a few hours. From a practical standpoint, because children often eat frequently throughout the day, strict attention to protein combinations at each meal appears to be unnecessary provided a variety of foods are used.

Calcium

Limited data suggest that calcium intakes of vegan children are below current recommendations (3,6,9). Fulton et al (4) found average calcium intakes among vegan preschoolers to be 39% to 84% of the current Adequate Intake (6).

Claims are commonly made that vegans require less calcium than omnivores, based on the lower acid production resulting from metabolism of plant proteins (18,19) and increased calcium excretion in response to increased protein intake (20,21). This issue has not been resolved (22-24). Consumption of soy products, which appears to be fairly typical among vegans, may also favorably affect bone health. Some research shows that soy isoflavones help to prevent breakdown and stimulate growth of bones (25). However, there is no research on the effects of these factors in vegan children. Because low bone mass and low calcium intake have been related to increased risk of fracture in children and adolescents (26), all vegan children should meet standard recommendations for calcium.

Although oxalates, phytates, and fiber in plant foods decrease calcium availability, research shows that absorption of calcium from many plant foods is excellent. Calcium absorption from low-oxalate vegetables, such as broccoli, kale, and collard greens, ranges from 52% to nearly 59% compared to 32% for milk (27). Calcium absorption from beans, nuts, and seeds is considerably lower.

Limited studies suggest that calcium in fortified foods, including fortified soy milk, is bioavailable (28,29). Table 2 lists calcium content of both fortified and unfortified foods. If children's diets do not contain adequate sources of dietary calcium, supplements may be advisable. Offering supplements between meals may reduce effects of mineral-mineral interactions on absorption.

Vitamin D

Exposing the hands and face to the sun 2 to 3 times per week for 20 to 30 minutes per session appears to provide adequate vitamin D in light-skinned children who live in moderate climates (30). However, dark-skinned children need longer sun exposure as do children living in cloudy or northern climates. Vitamin D is poorly supplied by foods; the best sources in most diets are fortified products, of which fortified cow's milk is the most common for US children. Rickets has been seen in some macrobiotic children who do not consume fortified foods, particularly those who live at northern latitudes (31,32).

If sun exposure is not adequate, parents of vegan children should be counseled to choose vitamin D-fortified products. Vitamin D-fortified soy milk and rice milk and breakfast cereals are available. Cereals containing animal-derived vitamin D may not be acceptable to many vegan families, however.

Vitamin B-12

Vitamin B-12 occurs in substantial amounts only in foods derived from animals. Vegan children can obtain adequate

Table 2
Top sources of calcium, iron, zinc, and vitamin B-12

Vitamin or mineral	Amount of source
Calcium	**mg**
Tofu, ½ c processed with calcium sulfate	250-390
Orange juice, 8 oz calcium-fortified	300
Soymilk, 8 oz calcium fortified	250-300
Rice milk, 8 oz calcium-fortified	250-300
Dried figs, 5	258
Apple juice, 8 oz calcium-fortified	200
Blackstrap molasses, 1 Tbsp	187
Collard greens, ½ c cooked	178
Sesame seeds, 2 Tbsp	176
Tahini, 2 Tbsp	128
Turnip greens, ½ c cooked	125
Kale ½ c cooked	90
Broccoli, ½ c cooked	89
Soybeans, ½ c cooked	87
Almond butter, 2 Tbsp	86
Textured vegetable protein, ½ c prepared	85
Bok choy, ½ c cooked	79
Tempeh, ½ c	77
Mustard greens, ½ c cooked	75
Navy beans, ½ c cooked	64
Vegetarian baked beans, ½ c	64
Great northern beans, ½ c cooked	60
Orange, 1	56
Black beans, ½ c cooked	51
Brazil nuts, 2 Tbsp	50
Almonds, 2 Tbsp	50
Iron	
Bran flakes, 1 c	11
Tofu, ½ c	6.6
Oatmeal, instant, 1 packet	6.3
Cream of wheat, ½ c	5.5
Garbanzo beans, ½ c cooked	3.4
Blackstrap molasses, 1 Tbsp	3.3
Lentils, ½ c cooked	3.2
Pumpkin seeds, 2 Tbsp	2.5
Navy beans, ½ c cooked	2.5
Lima beans, ½ c cooked	2.2
Swiss chard, ½ c cooked	1.9
Black beans, ½ c cooked	1.8
Tempeh, ½ c	1.8
Spinach, ½ c cooked	1.5
Turnip greens, ½ c cooked	1.5
Prune juice, ½ c	1.5
Apricots, ¼ c dried	1.4
Beet greens, ½ c cooked	1.4
Pasta, enriched, ½ c cooked	1.2
Wheat germ, 2 Tbsp	1.2
Raisins, ¼ c	1.1
Zinc	
Bran flakes, 1 c	5
Ready-to-eat breakfast cereal, ¾ c	1.5 to 4.0
Tempeh, ½ c	1.5
Textured vegetable protein, ½ c prepared	1.4
Brazil nuts, 2 Tbsp	1.3
Garbanzo beans, ½ c cooked	1.3
Tahini, 2 Tbsp	1.3
Lentils, ½ c	1.2
Black-eyed peas, ½ c cooked	1.1
Peanut butter, 2 Tbsp	1
Split peas, ½ c cooked	1
Oatmeal, instant, 1 packet	1
Peas, ½ c	1
Corn, ½ c	0.9
Vitamin B-12	**μg**
Ready-to-eat breakfast cereal, ¾ c	1.5 to 6.0
Meat analogs, 1 oz	2.0 to 6.7
Fortified soymilk/rice milk, 8 oz	1.5 to 3
Nutritional yeast, vegetarian support formula, 1 Tbsp	4.0

vitamin B-12 from fortified foods, including some breakfast cereals, soy beverages, nutritional yeast, and meat analogs (1). Unfortified nutritional yeasts, sea vegetables, tempeh, and algae are unreliable sources of vitamin B-12 (33,34). Parents of vegan children have been shown to be aware of the importance of providing their children with reliable sources of vitamin B-12 (3).

Riboflavin

Although riboflavin is sometimes identified as a nutrient of concern in vegan diets, intakes appear to be similar in vegans and omnivores (3,9). Some brands of soy milk are fortified with riboflavin but most are not, so careful label reading is advised. Other good sources include nutritional yeast, wheat germ, soybeans, mushrooms, leafy green vegetables, avocados, almonds, sea vegetables, fortified cereals, and enriched grains. Whole grains are not especially high in riboflavin. Including small amounts of enriched grains in place of whole grains can help to boost a child's riboflavin intake.

Zinc

The average zinc densities of the diets of vegan and nonvegan children are quite similar (14,35). Plant sources of zinc include legumes, whole grain pasta, wheat germ, fortified cereals, nuts, and tofu. However, the bioavailability of zinc from plant foods is reduced by phytate in whole grains and legumes.

Although whole grains are high in phytate, these foods are also higher in zinc than refined products so that the total zinc absorbed is greater from whole vs refined grains (36). Phytate is decreased when whole grain bread is leavened (36) and in the fermentation of soyfoods such as miso and tempeh (37). Because of these effects on phytate content of foods, zinc absorption may be higher than expected in vegan diets that utilize more leavened bread and fermented soyfoods. Overt zinc deficiency seen in developing countries has been observed primarily in children who consume diets high in unleavened grain products and have other predisposing factors for zinc deficiency such as parasitic infection (38, 39). This cannot be considered predictive of zinc status in Western vegan children.

In short-term studies of adults, total zinc absorbed has been shown to be lower on vegetarian diets than on omnivore diets because of lower zinc intake and absorption (40). Plasma zinc concentrations were also slightly lower although they were within normal ranges. It is possible that some adaptation takes place over the long term. There is some evidence that, in adults, zinc excretion decreases when dietary zinc is low (41,42). Whether such compensation occurs in children is not known. Assessment of zinc status is complicated by the fact that plasma zinc levels are not sensitive indicators of zinc pools.

Specific attention should be given to identifying zinc-rich foods for vegan children and to dietary factors that enhance zinc absorption. Protein is a promoter of zinc absorption (36,43) based on studies of individual meals in which total zinc intake was controlled. Emphasizing foods that are good sources of both zinc and protein, such as legumes and nuts, in diets of vegan children can increase both the content and absorption of zinc. Techniques such as soaking dried beans and discarding the soaking water before cooking and using yeast-leavened bread and fermented soy products like tempeh and miso can also enhance zinc absorption (44). If a child is following a vegan diet based on high-phytate cereals and legumes, zinc supplementation should be considered, especially in early childhood. (45).

Iron

Mean iron intakes of vegan preschoolers (ages 2 to 5 years) have been shown to be above the current RDA in a study (4) where results did not include iron from iron cookware or mineral supplements. In other studies, vegetarian children ages 6 to 12 years, about one-third of whom were vegan, also had iron intakes above the RDA (46) as did vegan children in Britain whose mean iron intakes were more than twice those of nonvegetarian children (3).

Although vegan children typically have iron intakes above recommended levels, nonheme iron has lower absorbability (47). Only 1 study we know of has reported iron status in vegan children. No significant difference in iron status indicators, including hemoglobin, serum iron, and ferritin were seen in vegetarian children ages 6 to 12 years, some of whom were vegan, compared to nonvegetarian children (46). No anemia was seen in any subjects of that study.

Research shows that vegetarian adults typically have lower iron stores than nonvegetarians and that a greater percentage of lacto-ovo-vegetarians have iron stores below the normal range, although most studies indicate that ferritin levels are within the normal range (17,48-52). Vegetarians, including vegans, generally have no higher rates of anemia than those seen in the general population (17).

Vitamin C and other organic acids commonly found in vegetables strongly enhance the absorption of nonheme iron (53-56). Vitamin C intakes of vegan children are frequently high (3,4,46) and this, in conjunction with generous levels of dietary iron, may compensate for the lower bioavailability of nonheme iron.

Vegan diets contain phytate and other factors found in soy protein and other legumes (57-59), nuts (60), and whole grains that inhibit iron absorption. Subjects do not appear to adapt to increased levels of dietary phytate (48), although some adaptation to diets with low iron bioavailability does occur (61).

Ascorbic acid and other dietary factors can promote iron absorption even in the presence of phytates (53,60,62-64). Iron bioavailability from soy foods is variable with iron absorption from tempeh and miso being superior to that from soy flour and tofu (65). The bioavailability of iron from soy milk has not been reported. Leavening of bread reduces the phytate content of wheat and enhances iron absorption (66).

Because iron deficiency anemia is a common nutrition deficiency among all population groups, it is important for parents to identify good sources of iron (including iron-fortified foods and iron supplements as needed) in vegan children's diets and to utilize dietary planning principles that maximize absorption of nonheme iron. Laboratory evaluation of iron status is appropriate if the child's diet is low in iron.

Fiber

The American Academy of Pediatrics recommends an upper limit for fiber in children's diets of 0.5 g/kg body weight per day (2). The American Health Foundation has proposed the Age Plus 5 guideline for fiber intake in children with age plus 10 g as an upper limit (67). This closely conforms to the American Academy of Pediatrics recommendations and is a useful guideline for counseling families.

Fiber intakes of vegan children are higher than those of both omnivores and lacto-ovo-vegetarians and may, in some cases, exceed recommendations (3). It is not known if there is any disadvantage to these higher intakes. If food intake is low due to early satiety, vegan children may benefit from the consump-

tion of some lower-fiber foods such as refined grains, fruit and vegetable juices, peeled fruits and vegetables, and added fats.

Fat and Essential Fatty Acids

Research suggests that vegan children consume less fat than omnivore and lacto-ovo-vegetarian children (3,68). Fat intake accounted for 31.5% of energy in 20 lifelong vegan school-aged children (3) and about 30% of energy in 37 lifelong vegan preschoolers (12).

Omnivore children who consume less than 30% of energy from fat appear to grow and develop normally (69,70) although some research suggests inadequate intakes of some nutrients with reduced fat intakes (71). Higher-fat foods such as nuts, seeds, avocado, soy products, and vegetable oils play an important role in helping vegan children meet energy and nutrient needs.

Vegan diets are generally lacking in the long-chain ϖ-3 fatty acids docosahexanoic acid (DHA) and eicosapentanoic acid (EPA) (although small amounts may be obtained from sea vegetables) and some studies show low blood levels of these fatty acids in vegan adults (72). The ϖ-3 fatty acid linolenic acid can be converted to EPA and DHA but efficiency of conversion is reduced in diets high in the ϖ-6 fatty acid linoleic acid (73). Sanders and Manning (3) found that vegan children had high intakes of linoleic acid compared to linolenic acid with a ratio of 44:1. Although there are no observed risks associated with diets low in long-chain ϖ-3 fatty acids, it may be prudent for vegan children to consume diets that enhance conversion of linolenic acid to DHA. Vegan diets for children should include sources of linolenic acid such as ground flax seed, canola oil, walnuts, and soy products and should make use of added vegetable oils that are relatively low in linoleic acid, like olive oil. Because *trans* fatty acids may also inhibit synthesis of the long-chain ϖ-3 fatty acids, vegetable oils and tub margarine are better choices in vegan diets than stick margarine (74).

COUNSELING PARENTS OF VEGAN CHILDREN

When counseling parents of vegan children, dietary assessment is necessary to determine which foods are excluded from the diet and which foods are acceptable. Some vegans avoid even small amounts of animal foods including additives that may be derived from animals, like the milk protein casein found in most brands of soy cheese. Many of the same issues that influence diet choices among omnivores, such as lack of knowledge of food preparation, lack of time, and economic constraints, are relevant for vegans. New vegans may not be familiar with a wide variety of vegan foods and may not be knowledgeable about where to find these foods and how to prepare them.

It is important to remember that requirements are for essential nutrients, not for specific foods. The Food Guide Pyramid, designed for those persons eating the typical American diet, is not an effective tool for assessment of adequacy of a vegan diet.

AGE-RELATED ISSUES IN COUNSELING PARENTS OF VEGAN CHILDREN

Toddlers and Preschoolers

As toddlers are weaned from breast milk or infant formula, the diet should be evaluated to ensure adequate food sources of calcium, iron, zinc, and vitamin B-12 are included. In some cases supplements may be indicated. Vegan toddlers should be provided with foods of high energy density and be offered 3 meals and 2 to 3 snacks per day. Popular snack ideas for vegan preschoolers include nut butters on crackers or miniature bagels, fresh fruit, fruit juices, raw vegetables with hummus or tofu dip, dry breakfast cereals, and breads.

The wide availability of convenient vegan foods, many of which are fortified, make it increasingly easy to plan healthful vegan diets for children

From age 18 months to 3 years, growth rate slows and appetite often decreases. Children may form strong food and eating preferences and are likely to reject unfamiliar foods. Repeated exposure can result in eventual acceptance of foods (75) and parents should offer a variety of foods and model food preferences as toddlers' food preferences have been shown to be markedly affected by the foods offered them (76).

Choking is a concern for toddlers. Foods such as nuts, raw celery and carrots, and popcorn should be avoided or eaten only by older preschoolers with supervision. Food modifications to reduce choking risk include finely grinding nuts, slicing vegetarian hot dogs lengthwise and then crosswise, cutting raw grapes and cherries in half and removing seeds and pits, and quartering cherry tomatoes.

School-Age Children

School introduces a new set of challenges for vegan families. Children may learn for the first time that their diet is considered "alternative" and nutrition education lessons in the classroom may be at variance with the way the child's family eats. Although some children may experience discomfort with eating differently from friends, this is less likely to be a concern as vegetarianism becomes increasingly mainstream. In many schools, school lunch programs offer very little that is acceptable to vegan children and children may need to rely on lunches brought from home.

Adolescents

Despite good appetites, teenagers, who are often on their own for meals, may not always make the most healthful diet decisions. Teenage girls are often concerned with body weight and may restrict energy, making it difficult to meet the high nutrient needs of this stage of life.

Table 3
Food guide for vegan toddlers

Food	Servings per day	Serving sizes
Grains	6+	½ to 1 slice bread; ¼ to ½ c cooked cereal, grain, or pasta; ½-1 c ready-to-eat cereal
Vegetables	2+	¼-½ c cooked; ½-1 c raw
Fruit	3+	¼-½ c canned; ½ c juice; ½ medium piece of fruit
Legumes/nuts	2+ (include at least 1 serving per day of nuts/seeds or 1 full-fat soy product)	¼-½ c cooked beans, tofu, tempeh, or textured vegetable protein; 1½ -3 oz meat analog; 1-2 Tbsp nuts, seeds, or nut or seed butter
Fortified soymilk or breast milk	3	1 c
Fats	3-4	1 tsp margarine or oil

Table 4
Food guide for vegan preschoolers and school-aged children

Food	Servings for ages 5-6 years	Servings for ages 7-12 years	Serving sizes
Grains	6+	7+	1 slice bread; ½ c cooked cereal, grain, or pasta; ¾-1 c ready-to-eat cereal
Vegetables	2+	3+	½ c cooked; 1 c raw
Fruits	2+	3+	½ c canned fruit; ¾ c juice; 1 medium fruit
Legumes	1-2	2-3	½ c cooked beans, tofu, tempeh, or textured vegetable protein; 3 oz meat analog
Nuts	1	1	2 Tbsp nuts, seeds, or nut or seed butter
Fortified soymilk	3	3	1 c
Fats	4	5	1 tsp margarine or oil

Much concern has been raised about the possible relationship between vegetarian diets among teenage girls and eating disorders. A survey conducted in 1986-1987 among Minnesota teenagers showed that vegetarians were much more likely than nonvegetarians to engage in disordered eating behaviors (77). Martins et al (78) found that vegetarianism was associated with disordered eating only among certain groups. Although data are limited, it is clear that some girls with eating disorders use vegetarian diets as 1 tool to mask this behavior. Consuming a vegetarian diet does not appear to raise risk for eating disorders, however (79).

Many American teenagers do not consume enough calcium (80) and some data suggest that lacto-ovo-vegetarian adolescent girls do not meet their calcium needs (17). If adolescents do not get enough calcium from dietary sources, a supplement may be necessary. Teenage girls are at high risk in general for iron deficiency anemia (81). As noted, vegan diets are typically high in iron, but all vegan teenagers should have diets that are adequate in vitamin C to enhance bioavailability of non-heme iron.

A growing phenomenon is the number of vegan teenagers in omnivore households. Dietitians must be prepared to offer support and a great deal of specific guidance because both the adolescents and their parents may be unfamiliar with vegan foods and guidelines for menu planning. It is crucial to elicit support from parents, because teenagers may not plan optimal diets on their own. Parents can show support by learning about both the health benefits of vegan diets and menu-planning guidelines, by purchasing special foods for the vegan adolescent, and by introducing more vegan meals that the whole family enjoys, such as spaghetti with marinara sauce, as well as meals that can be served with and without meat, such as tacos served with meat or textured vegetable protein or stir fries served with meat or tofu.

Some ideas for foods to stock for vegan teenagers include: dried fruits, trail mix, popcorn, cheeseless pizza, instant hummus mix and pita bread, muffins, juice, nut butters, instant soups, instant bean mixes, bean burritoes, veggie burgers, and fortified soy milk in single-serving cartons.

MEAL-PLANNING GUIDELINES FOR VEGAN CHILDREN

Tables 3 and 4 offer guidelines for feeding vegan children. Dietitians may need to give parents additional advice for making appropriate and practical choices from within the food groups.

Vegetables and Fruits

All children should consume a wide variety of vegetables and fruits. Green leafy vegetables, often rich in calcium and riboflavin, are especially valuable in vegan diets.

Grains

Although the emphasis should be on whole grains, refined grains can help young vegan children meet energy and nutrient needs. Vegan children may come closer to the American Academy of Pediatrics recommendations for fiber intake by consuming half of their servings of grains as refined products.

Legumes

Dried beans, peas, lentils, and soy products play an important role in vegan diets as key sources of energy, protein, iron, zinc, and calcium. Many soy products are especially rich in protein and sometimes calcium and can be versatile and useful as meat substitutes. To encourage children to consume legumes, make legumes into spreads such as hummus and serve on crackers or slices of apples; serve roasted soynuts as snacks or in salads; or add chopped legumes to loaves or veggie burgers.

Nuts and Seeds

Nuts and seeds are important in the diets of vegan children as they are rich in protein, essential fats, energy, and trace minerals. Spread nut and seed butters on bread, crackers, and slices of raw fruits and vegetables.

Fortified Soy milk

Although soy milk is not essential in the diets of vegan children, the fortified brands are useful in helping children meet needs for calcium and vitamin D. For some families, the cost of 3 c soy milk per day may be prohibitive. The use of powdered soy milk (sometimes available in bulk in natural foods stores) may be helpful. When vegan children consume fewer than 3 servings per day, dietitians will need to help parents identify other foods that can help children meet needs for protein, calcium, vitamin D (where necessary) and vitamin B-12. If lower-protein beverages such as fortified rice milk or fruit juices are used in place of soy milk, other protein sources such as legumes, nuts, or grains, should be increased to compensate for the lower protein intake.

Fats

Small amounts of added fats help vegan children meet needs for energy and essential fatty acids. Vegetable oils that are rich in linolenic acid and/or low in linoleic acid are the best choices for regular use. Children can also have moderate amounts of soft margarine to help meet energy needs.

APPLICATIONS/CONCLUSIONS

Vegan diets can meet the nutrition needs of children if appropriately planned by a knowledgeable adult. Limited research indicates that vegan diets can support growth that falls within normal ranges. The wide availability of convenient vegan foods, many of which are fortified, make it increasingly easy to plan healthful vegan diets for children. All vegan children should regularly consume foods fortified with vitamin B-12 or use a supplement. A vitamin D supplement is necessary if sun exposure is not adequate and parents of vegan children need to give extra attention to including adequate calcium, zinc, and iron in the diet and to incorporating dietary practices that enhance absorption of zinc and iron from plant foods. In addition to staying aware of the nutrition issues that are relevant to planning vegan diets, dietetics professionals may need to be familiar with availability of vegan foods in their community and with methods of preparation.

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PRACTICE POINTS

A successful diet for vegan children nourishes the child

"When designing a nourishing vegan diet for children, parents should remember that kids are not miniature adults," says Brenda Davis, RD, chair of the vegetarian nutrition dietetic practice group. Davis points out that dietary goals for children differ from those of adults, because children need to focus on achieving adequate growth and development.

"A vegan diet just isn't successful if it fails to nourish the child. The diet should be calorie dense. We've seen some problems where some raw food diets are simply not high enough in calories for small children. Essential fatty acids are also important to this diet. Things like nut butters, tofu and avocados can provide a healthy source of fat and allow the body to absorb important minerals. And I can't stress enough the importance of B12 in a child's diet. There are some very popular vegan advocates out there right now who say we don't have to worry about B12. But I would stress that the consequences of B12 deficiencies, which can cause irreversible damage, are not worth the risk. From birth, vegan children need to be provided with sources of B12."

From 18 months to about three years of age, growth rates for children can slow down, which means their appetite may decrease. This can present a unique challenge for nutritionists counseling vegan families, but Davis says there are a number of easily prepared foods that will appease even the most finicky eaters, such as avocado pudding or a tofu drink mixed with frozen bananas and strawberries.

"When children reach this stage of growth and are no longer breastfeeding, it is also important to provide a milk source that is rich in fat," adds Davis. "I would be cautious about rice milk because it is low in protein. I would suggest using a milk that is rich in calcium, B12 and riboflavin."

As vegan children continue to grow and mature, issues other than food choice and nutrition begin to affect the school-aged youngster.

"Even though the vegan lifestyle has become more mainstream, children still get teased by other children," says Davis, a mother of two vegan teenagers. "I think it's really important to educate young children on why they are making these [dietary] choices instead of pretending like everybody does it in an effort to prepare them for functioning in the outside world. They should also be taught to respect other children's choices and to not be angry with those who choose to eat animals. Explain to them that they are not bad people and that not everyone respects the environment in the same way. Some people focus on starving children, some worry about pollution or recycling or other such issues."

Another way parents can help their vegan children feel comfortable in their daily interactions with non-vegans is to be educated themselves on the variety of products and options now available on the market, such as vegetarian turkey, vegetarian baloney, or vegetarian hamburgers.

"Some people might ask, 'As a vegan, why would you want to eat something like a fake turkey?' Well, in reality most vegans don't dislike the taste of meat, they just don't like eating animals. So, when they eat these vegan products, especially the children, it makes them feel like they are part of the group."

This article was written by Tony Peregrin, an editor of the Journal *in Chicago, Ill.*